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ABSTRACT

In the US, while policy-makers and researchers continue to recommend broad changes in school mathematics content, instruction and assessment, little is known about why teachers struggle to implement reforms. This is particularly problematic for teachers who work in high poverty, diverse school districts precisely because of the unique sociopolitical contexts of schooling in these communities. In this paper, preliminary results of a research study are reported in which 28 secondary-level mathematics teachers who work with diverse students in one of the poorest states in the US identify barriers to employing progressive instructional strategies in their classrooms. Specifically, the teachers describe how the intensification of their workload, the lack of support provided by administrators, colleagues, and parents and resistance from significance of a sociopolitical perspective to understand barriers to reform particularly for teachers working with high poverty, diverse communities. (Author)

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Transforming mathematics education: Barriers to reform in high poverty, diverse schools

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In the US, while policy-makers and researchers continue to recommend broad changes in school mathematics content, instruction and assessment, little is known about why teachers struggle to implement reforms. This is particularly problematic for teachers who work in high poverty, diverse school districts precisely because of the unique sociopolitical contexts of schooling in these communities. In this paper, preliminary results of a research study are reported in which 28 secondary-level mathematics teachers who work with diverse students in one of the poorest states in the US identify barriers to employing progressive instructional strategies in their classrooms. Specifically, the teachers describe how the intensification of their workload, the lack of support provided by administrators, colleagues, and parents and resistance from students serve as obstacles to implementing reforms. These findings highlight the significance of a sociopolitical perspective to understand barriers to reform particularly for teachers working with high poverty, diverse communities.

Introduction

Reforms in mathematics education recommended and supported by national organizations in the United States (see NCTM, 1989, 2000; NSF, 1996) stress the need for a problem-solving rich curriculum and instructional strategies that foster the development of students' reasoning and communication skills. Seldom do these documents acknowledge the sociopolitical contexts in which teachers labor nor are specific approaches offered to teachers to support *all* students, particularly diverse students from high poverty communities, learn challenging mathematical content. The incongruity between the reform vision and how the majority of practicing teachers were taught mathematics, (teaching that focuses on memorization and following procedures) is well established. To implement reforms, teachers will need on-going access to professional development experiences that model the ways in which teachers are being asked to teach (Ball & Cohen, 1999; Smith, 2001). Indeed, the professional culture of mathematics education must be transformed and requires extensive changes in teachers' deeply held beliefs, knowledge and habits of practice (Thompson & Zeuli, 1999).

While the how to design transformative professional development experiences for mathematics teachers is gaining long-overdue attention (Loucks-Horsley, et al., 1998; Smith, 2001), little research has explored the many barriers to reform and how teachers need to be supported to overcome them. This is particularly problematic in schools that primarily serve high poverty, diverse communities precisely because of the unique sociopolitical contexts of schooling in these communities. Loucks-Horsley and her colleagues (1998) identified some of the constraints that may inhibit teachers from pursuing reform, including: 1) Lack of instructional resources such as textbooks, manipulatives, and technology; 2) District mandates imposed upon

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teachers such as standardized testing; and 3) Daily constraints such as class length, the requirement to assign students grades quarterly, and the lack of planning periods shared with colleagues. In this paper, I present preliminary findings of a research project conducted with participants in a professional development academy that provides further insight into the complexity of issues that hampers the transformation of the mathematics education culture, particularly in schools that serve high poverty, diverse student populations.

High poverty, diverse schools have unique sets of problems that distinguish them from more homogeneous, affluent schools. For example, at high poverty schools, students often attend classes in dilapidated facilities, have a higher percentage of novice teachers, have teachers without a teaching credential and teachers who are teaching subjects in which they have neither a major nor a minor (Ingersoll, 1999; NRC, 2001). Many scholars (see for example, Kozol, 1967) have highlighted similar characteristics of schools that serve diverse populations (defined as schools that serve a majority minority population). For example, these schools have fewer resources and poorly trained teachers in contrast to predominately white schools, particularly white suburban schools. Fetler (1999) investigated the relationship between a teacher's experience in mathematics and educational level, and student achievement in mathematics. A conclusion of Fetler's study was that student achievement in mathematics significantly correlated with teacher experience and preparation. This finding is particularly significant for high poverty, diverse schools that have greater teacher turnover rates and higher concentrations of novice teachers than in more affluent schools.

The design of the Secondary Mathematics Academy

In the summer of 2001, with the support of a grant from the US Department of Education, the University of New Mexico offered four professional development "academies." The author served as the coordinator of the only secondary mathematics academy. The fundamental premise of the three-week summer academy was to engage teachers in the rigorous study of a challenging, problem-solving based curriculum to build the participants' deep and flexible understanding of mathematical content (Thompson & Thompson, 1996; Sowder et al., 1998). In addition, the mathematics was taught in ways that reflect the style of teaching and learning that reformers advocate (e.g., Simon & Schifter, 1991). During the 2001-2002 academic year and the summer of 2002, continued professional development experiences are being collaboratively designed and implemented with the participants and distributed throughout the school year.

Based upon Silver's notion of a collaborative community (1996), a premise that has guided the design of the summer academy and continues to guide the project is that reforms can only proceed in classrooms and in schools in which respect, collaboration and equity are valued. Attention has also been given to how professional development experiences for secondary-level mathematics teachers *should* be organized (Goldenberg & Gallimore, 1991; Little, 1993; Loucks-Horsley et al., 1998). In particular, 1) programs should

be lengthy rather than brief; 2) teachers should have a role in defining the content; 3) regular meetings should be interspersed with classroom practice; and 4) means should be devised to encourage teachers to collaboratively problem solve over an extended period of time.

Research Methodology

The participants in the summer mathematics academy identified and continue to document barriers to reforming their classroom practices and implementing innovative instructional strategies. Qualitative methods were used to identify major patterns and themes related to the impediments to reform (Miles & Huberman, 1984; Strauss & Corbin, 1990). Data sources included a series of surveys, journal entries and written reports completed by participants.

Academy Participants

There were 28 participants in the summer academy. Thirty-nine percent of the participants are people of color, five are Native American, five are Hispanic and one identified himself as "Middle Eastern." Eighteen of the teachers were licensed to teach secondary mathematics and six of the participants held a credential to teach in the elementary school (grades K-8). The remaining four participants did not hold a teaching license. Novice teachers were actively recruited to participate in the academy. Fifty percent of the participants had worked in education (teacher, support staff person, administrator, etc.) for six years or less, while 11% of the participants had been in education for 21 years or more. All of the participants worked in high poverty schools that primarily served large populations of Hispanic and/or Native American students.

Preliminary research findings

The most striking initial research finding was that the teachers' overwhelming workload served as the primary barrier to reforming their classroom practices and implementing innovative instructional strategies. One teacher wrote that it is difficult to devote time and energy to reforming her classroom practices because of "Too much paperwork, grading, no prep time (because of team meetings and parent conferences), too many meetings, parent conferences make it difficult to want to change, I'm just too tired." She continued by writing that, "Inservices are nice, but more time, more prep time, more grading time would make reform in math much more applicable! Otherwise you're too tired to care!"

In the US, the intensification of teachers' work is well documented (see Apple, 1990). This was reflected in many of the teachers' responses. For example, one teacher wrote, "I am in charge of student council, astronomy club, class of 2004, curriculum committee, outdoor club for girls,... free time, what free time? It makes it hard to do research and stay upbeat about teaching." A distinct aspect of schooling in the US is that competent and/or novice teachers are frequently relied upon to supervise a variety of extracurricular activities. Another teacher wrote about the constant changes that she has recently dealt, "My teaching assignment has changed 3 times in 6

weeks, and may change one more time next week. I need consistency... I was also given the task of preparing syllabi for 5 subjects within 2-4 days." This teacher highlights another aspect of US schools, poorly defined work conditions, a common characteristic of high poverty, diverse schools. Such conditions clearly hamper a teacher's capacity to construct a classroom environment that is conducive to the implementation of progressive instructional strategies.

Another major theme that emerged from the survey was the lack of support from administrators, colleagues, parents and even substitute teachers for reform. One academy participant wrote that,

> I don't feel that I am supported by my administration and veteran teachers. On one hand, they say use manipulatives, and on the other they say you need 2 to 3 grades in the gradebook per week. Parents want their kids to do Math traditionally also. I even had a substitute teacher criticize my teaching as just playing!

Because of the design of the Academy, many of the participants were the sole representatives from their school. Being the lone mathematics reformer at the school is a plight that many of the participants are experiencing for the first time. Lastly, many teachers work with students who have never been asked to communicate their mathematical reasoning in the classroom. One teacher who works in a high poverty school with a large African-American population wrote,

> I tried groups, they only chat and play with the manipulatives, and they won't and don't do the 'math'! They wait for someone to do 'it' so they can copy (if no one in the group does it for the group, they just sit). Grades are not a motivator. Most of my 8th graders have received an F in math for the past 5 years. [They say] 'What's one more F?'

The student resistance that this teacher is experiencing (Willis, 1981) is a challenge to one of the central tenets of reform documents, to create a discursive classroom community. More generally, it serves as an example of the unique sociopolitical challenges faced by teachers in diverse, high poverty schools to implement reforms. For instance, many respondents identified parents, and their beliefs that mathematics should be taught in a traditional manner, as an impediment to innovation. This is interesting given that the communities served by the Academy participants include large numbers of people who experienced incredibly oppressive schooling experiences. In New Mexico, Native Americans were until recently often sent to boarding schools in which their cultures and languages were actively suppressed. Hispanics attended schools at which students were routinely punished for speaking Spanish. Despite this, they are now defending traditional mathematics curriculum and instruction precisely because that is what they experienced

Final remarks

Some preliminary research findings have been described that identify some of the barriers faced by teachers to implement innovations in their classrooms. A major sociopolitical impediment to reform described by the teachers included

an overwhelming workload. New Mexico compares with Louisiana and Mississippi as among the states with the highest poverty rates. For teachers to implement reforms in mathematics education in New Mexico, support must come from school boards, administrators, politicians and others to improve teachers' working conditions. The lack of support for and resistance to reform as demonstrated by administrators, other teachers, parents and students as described by the participants only magnifies the difficult work that needs to be accomplished.

Providing professional development opportunities for teachers in New Mexico presents unique challenges. Given the uniquely defining characteristics of this state, sociopolitical considerations take on greater import in the professional development of mathematics teachers. The results of this study highlight the many formidable challenges that the Academy participants face to implement progressive reforms in their classrooms. These findings also directly challenge policy-makers and reform advocates to pay more attention to the real barriers to reform as identified by teachers, particularly in schools serving diverse, high-poverty communities.

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